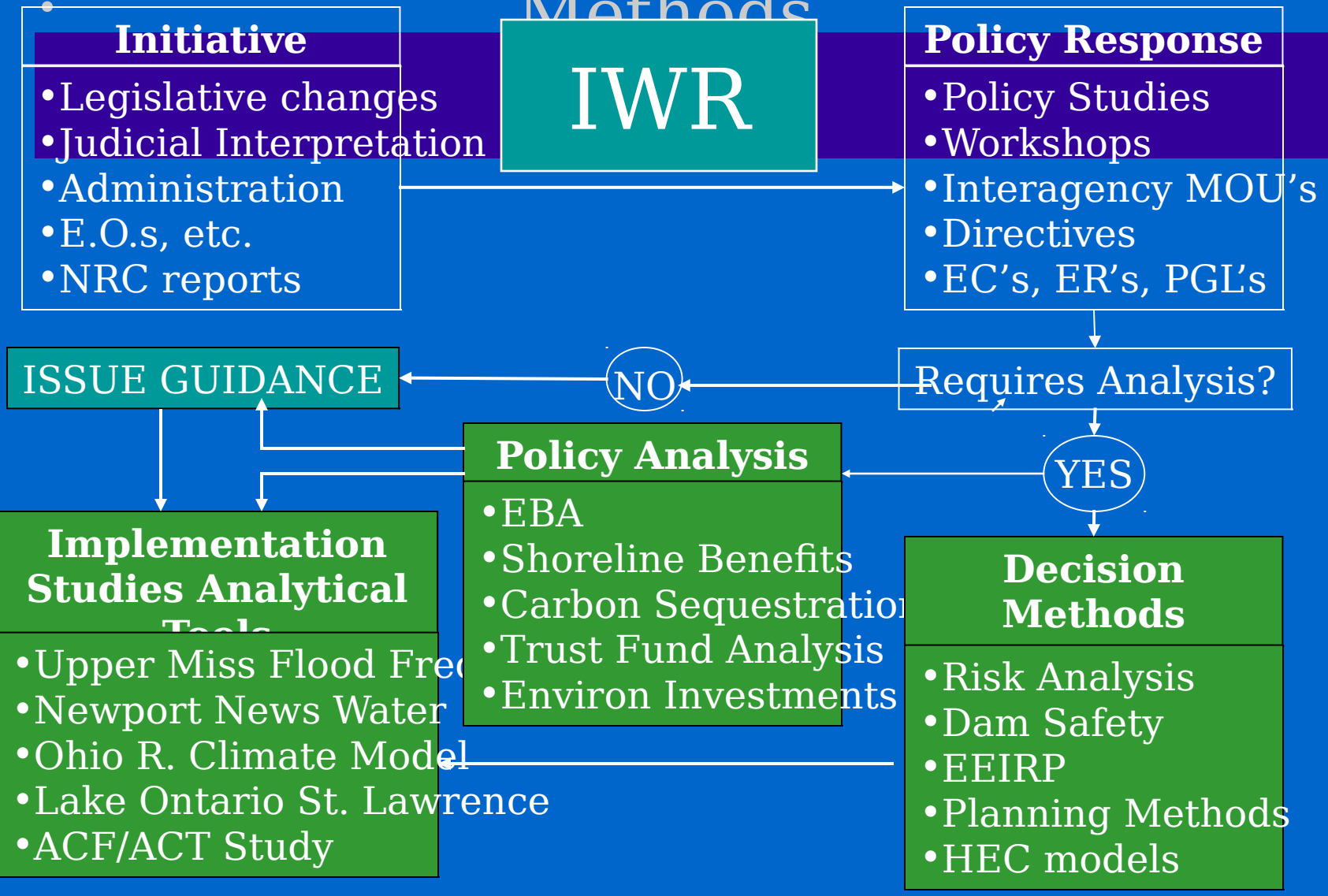
Sustainable Development: Mirage or Virtual Reality?

Eugene Stakhiv
Institute for Water Resources
Corps of Engineers

SPD Planning Conference

Process for Developing Analytical Methods



OVERVIEW

- The “Big Picture” Context
- Definitions of Sustainable Development
- Requirements for SD to Succeed
- Linkages to Evaluation and Analysis
- Some Corps Initiatives
- What next?

The “Big Picture”

- Mirage or Virtual Reality?
- Historical Evolution
- SD and IWRM
- NEPA Process
- Corps initiatives that “contribute to SD”

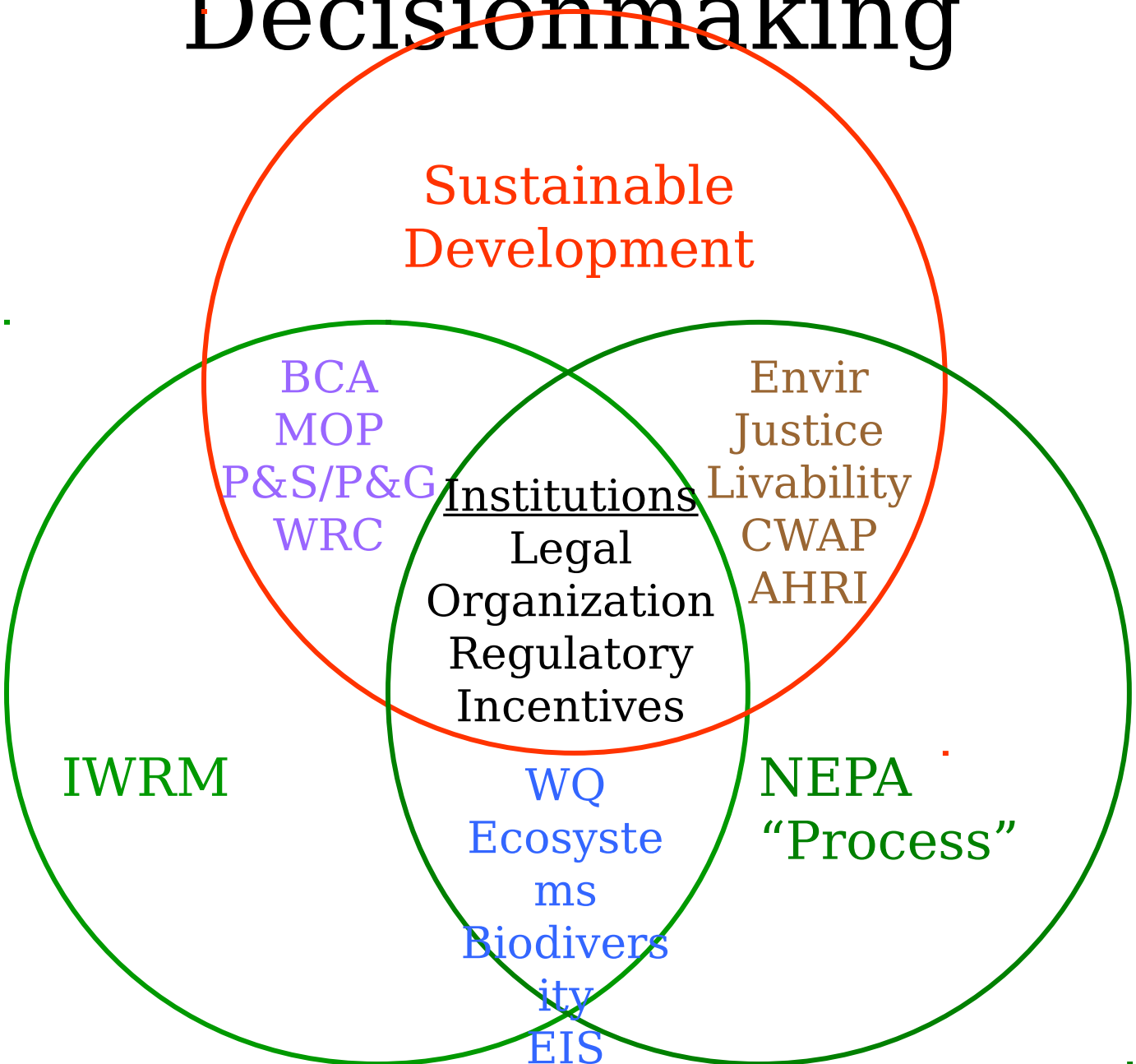
Definitions

- Brundtland Commission: *“development that meets the needs of the present without compromising the ability of future generations to meet their own needs”*
- ASCE: *“Sustainable water resource systems are those designed and managed to fully contribute to the objectives of society, now and in the future, while maintaining their ecol., environ., and hydrol. integrity”*

PCSD(1999) Reiterates NEPA(1969)

- Fulfill the responsibilities of each generation as trustee for the environ for succeeding generations
- Assure a safe, healthful, productive, and esthetic-ally and culturally pleasing surroundings
- Attain the widest range of beneficial uses of the envir. without degradation, risk to health or safety, or other undesirable or unintended consequences
- achieve balance between population and resource use, permitting high standards of living & amenity
- enhance use of renewable resources, recycling, etc

Context for Decisionmaking



PCSD “Overarching Elements”

- **Economic Efficiency**
- **Environmental Health**
- **Social Well-being and Equity**

“the three elements are interdependent and must be pursued simultaneously and in a balanced way if sustainable development goals are to be met” ***(sounds like the original Principles and Standards of 1973/80!)***

National Goals for Achieving SD

- **1. Health & Environment**
- **2. Economic Prosperity**
- **3. Equity**
- 4. Conservation of Nature
- 5. Stewardship
- 6. Sustainable Communities
- 7. Civic Engagement
- 8. Population
- 9. International Responsibility
- 10. Education

Messages in the PCSD

- No action to date by Administration to impl
- 75% of actions apply to non-federal sectors
- No decision rules, or evaluation principles
- No connections with existing Administra. initiatives, e.g. Amer Heritage Rivers
- Transform into vague “Livability Agenda”
- Emphasis on social engrg, “civil society”

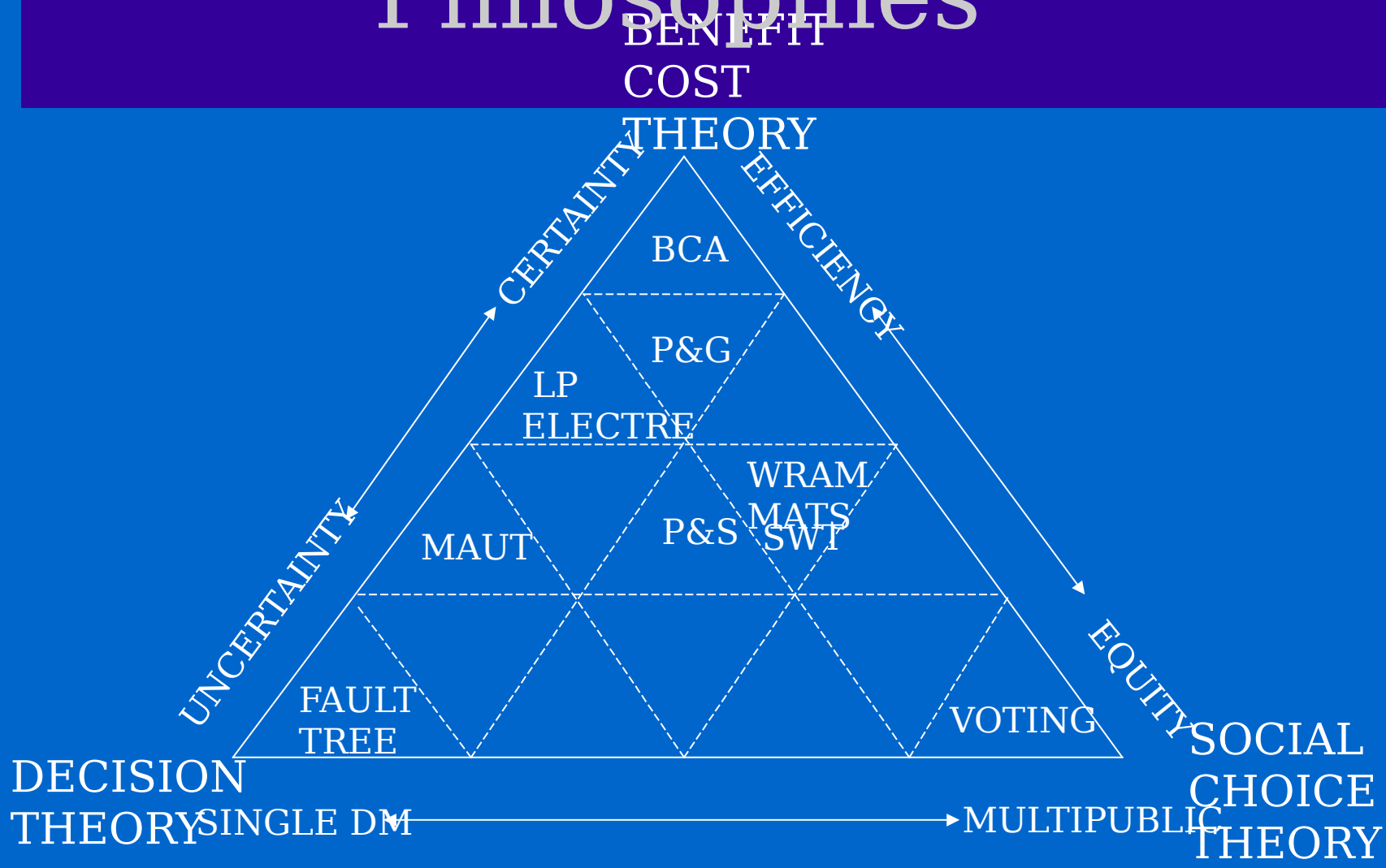
EQUITY

- **Procedural Equity** - access to and influence on the planning process and decisions; transparency, public participation
- **Consequential Equity** - equity of outcomes (parity, proportionality, priority, classical utilitarianism{NED/BCA}, Rawlsian distributive justice{affirmative action})

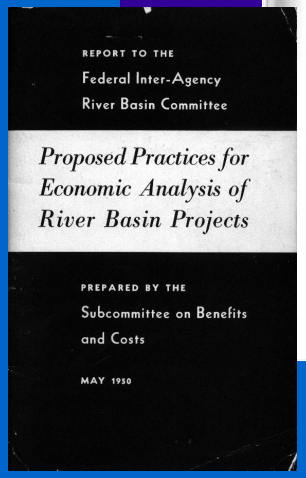
Existing Planning/Evaluation Paradigms

- **Descriptive** (NOAA/CZM, McHarg, GIS)
- **Indicative** (normative, P&S/P&G, BCA)
- **Prescriptive** (regulatory planning- an oxymoron?)
- **Proscriptive** (to avoid, NEPA/EIS)
- **ERSATZ** (Ecorestoration sitting around the table *Zeitgeist,* see EPA Watershed guidelin
- **“Garbage Can” Planning** (see Ersatz)

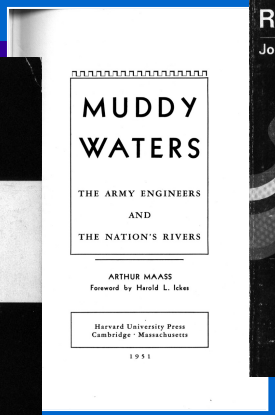
Normative Evaluation Philosophies



EVOLUTION OF FEDERAL WATER RESOURCES PLANNING GUIDELINES



1950



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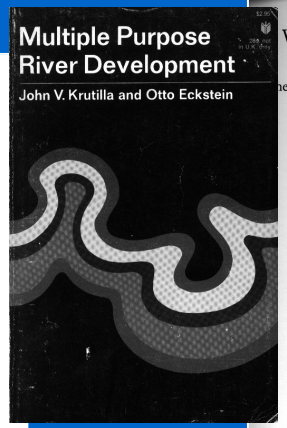
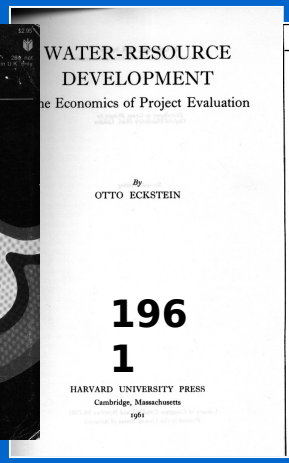
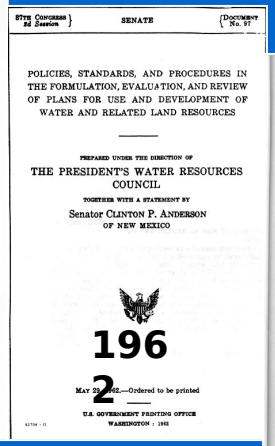


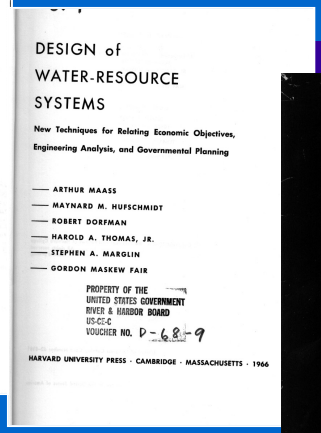
1958



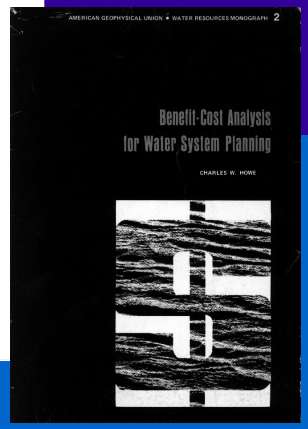
1961


87TH CONGRESS 2d Session
SENATE
DOCUMENT No. 97
POLICIES, STANDARDS, AND PROCEDURES IN THE FORMULATION, EVALUATION, AND REVIEW OF PLANS FOR USE AND DEVELOPMENT OF WATER AND RELATED LAND RESOURCES
PREPARED UNDER THE DIRECTION OF
THE PRESIDENT'S WATER RESOURCES COUNCIL
TOGETHER WITH A STATEMENT BY
Senator CLINTON P. ANDERSON
OF NEW MEXICO
U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON

1962


DESIGN of WATER-RESOURCE SYSTEMS
New Techniques for Relating Economic Objectives, Engineering Analysis, and Governmental Planning
ARTHUR MAASS
MAYNARD M. HUFSCHMIDT
ROBERT DORFMAN
HAROLD A. THOMAS, JR.
STEPHEN A. MARGLIN
GORDON MASKEW FAIR
PROPERTY OF THE UNITED STATES GOVERNMENT
RIVER & HARBOR BOARD
US-CE-C
VOUCHER NO. D-68-9
HARVARD UNIVERSITY PRESS · CAMBRIDGE · MASSACHUSETTS · 1966

1962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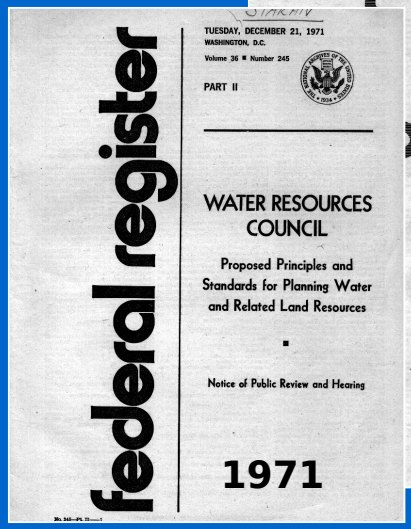
CHARLES W. HOWE

1971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WASHINGTON, D.C.
Volume 36 ■ Number 245
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Proposed Principles and Standards for Planning Water and Related Land Resources
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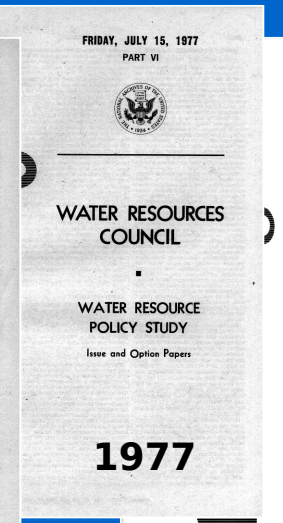
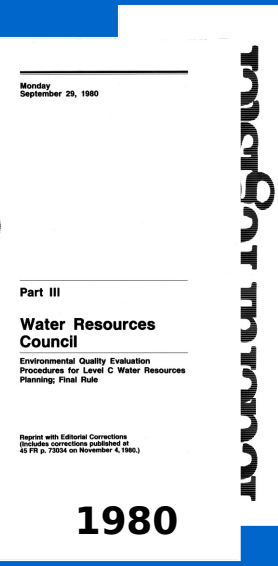
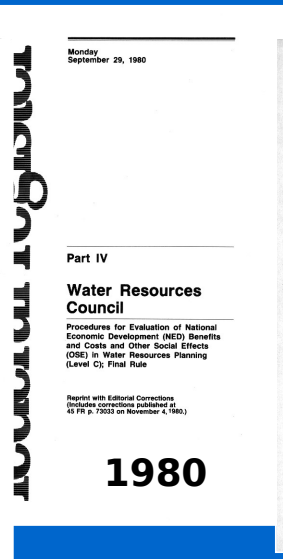


1977


Monday
September 29, 1980
Part III
Water Resources Council
Environmental Quality Evaluation Procedures for Level C Water Resources Planning; Final Rule
Reprint with Editorial Corrections (Includes corrections published at 45 FR p. 73034 on November 4, 1980.)

1980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Water Resources Council
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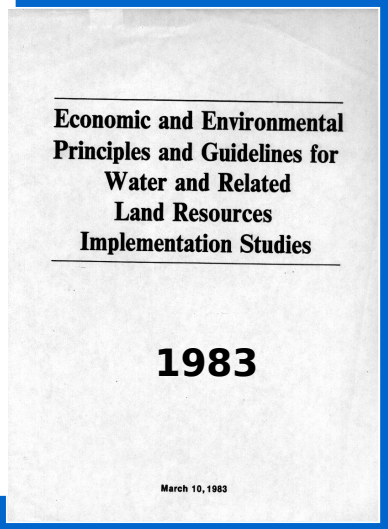
Reprint with Editorial Corrections (Includes corrections published at 45 FR p. 73033 on November 4, 1980.)

1980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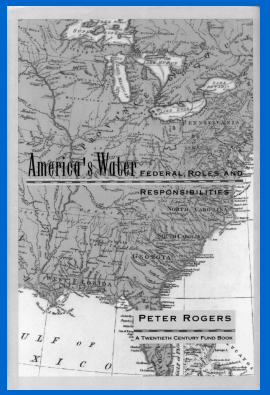
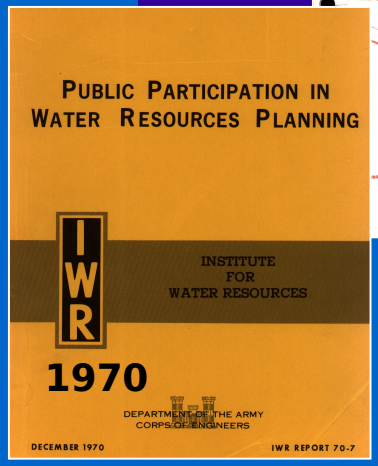
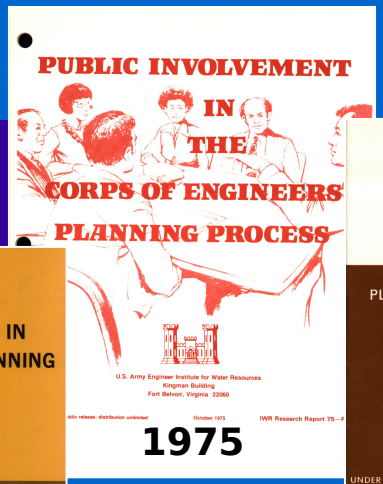
1983
March 10, 1983



1993

EVOLUTION OF PUBLIC PARTICIPATION/ADR IN THE CORPS PLANNING PROCESS

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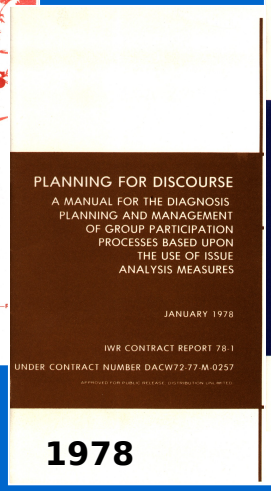
U.S. Army Engineer Institute for Water Resources
Kingman Building
Fort Belvoir, Virginia 22060
1975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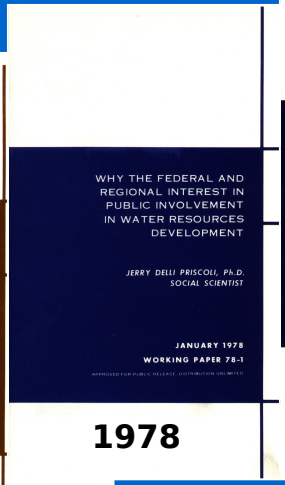
1978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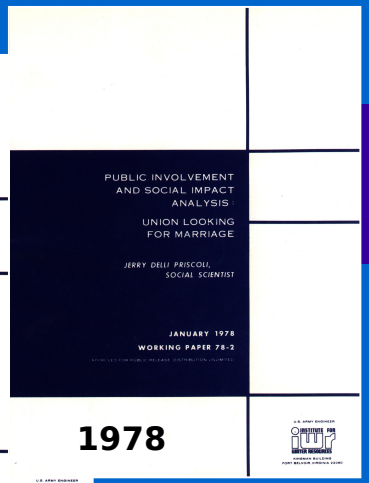
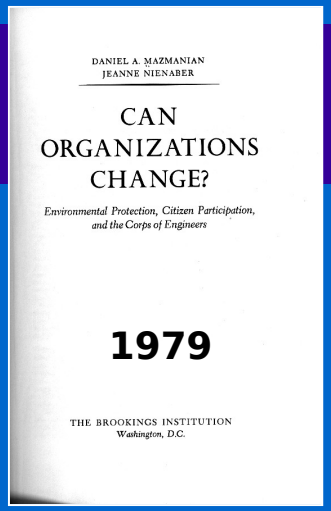
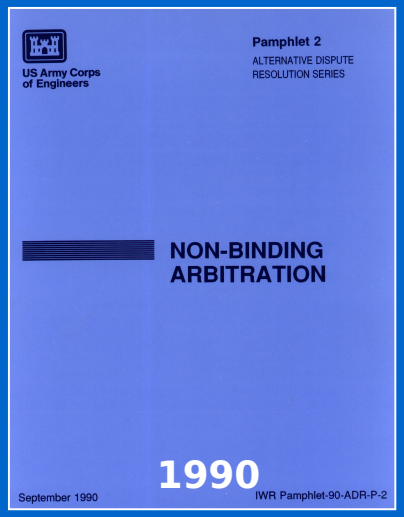
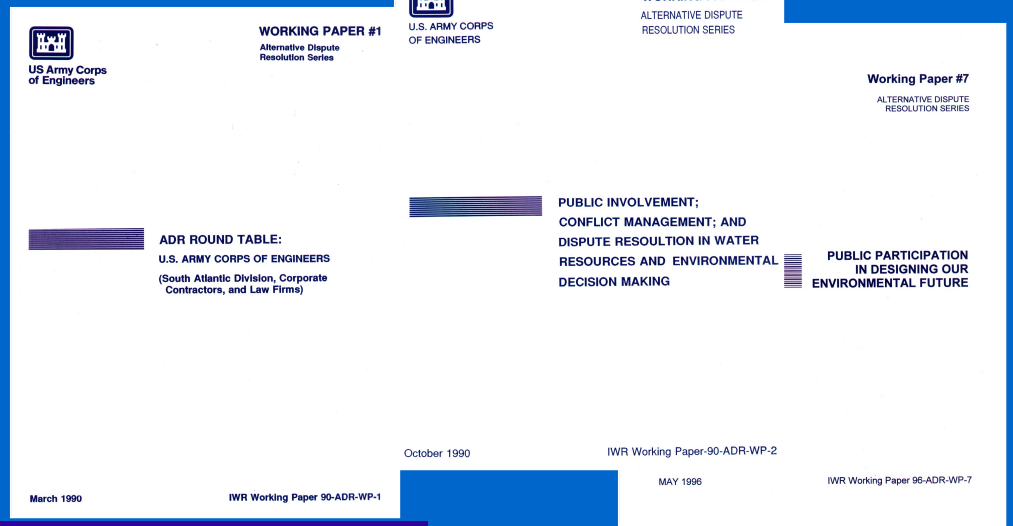
JERRY DELLI PRISCOLI, Ph.D.
SOCIAL SCIENTIST
JANUARY 1978
WORKING PAPER 78-1
1978








US Army Corps of Engineers
WORKING PAPER #1
Alternative Dispute Resolution Series
ADR ROUND TABLE:
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(South Atlantic Division, Corporate Contractors, and Law Firms)
March 1990
IWR Working Paper 90-ADR-WP-1
U.S. ARMY CORPS OF ENGINEERS
WORKING PAPER #2
ALTERNATIVE DISPUTE RESOLUTION SERIES
PUBLIC INVOLVEMENT; CONFLICT MANAGEMENT; AND DISPUTE RESOLUTION IN WATER RESOURCES AND ENVIRONMENTAL DECISION MAKING
October 1990
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PUBLIC PARTICIPATION IN DESIGNING OUR ENVIRONMENTAL FUTURE
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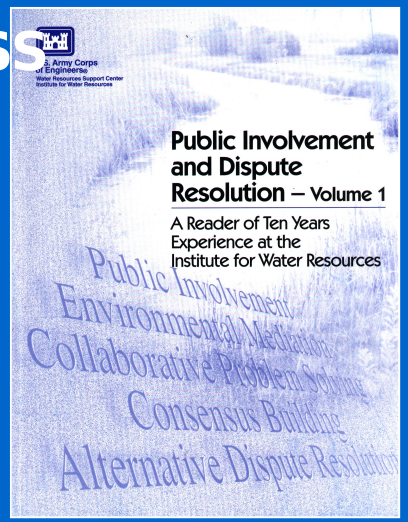

Public Involvement and Dispute Resolution – Volume 1
A Reader of Ten Years Experience at the Institute for Water Resources
Public Involvement
Environmental Mediation
Collaborative Problem Solving
Consensus Building
Alternative Dispute Resolution
1998

PCSD & Ecomanagement

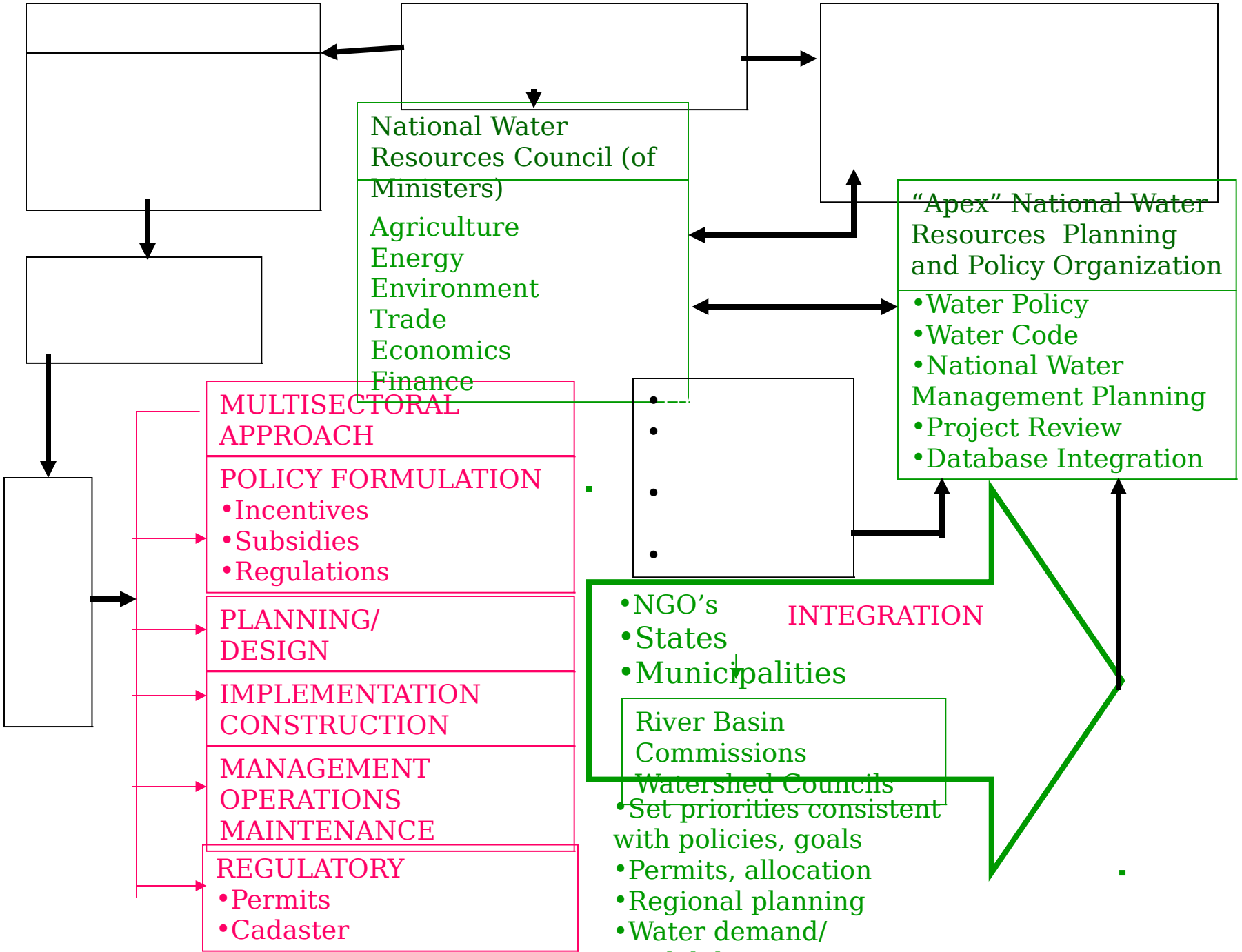
- Foster performance-based, efficient and effective regulatory system
- Support innovation in environ mgmt
- Provide incentives for regulatory flexibility
- Full accounting of natural resource depletion costs
- Restore ecosystems, protect biodiversity
- Develop ecological sustainability indicators

Pilot Environmental Sustainability Index

- Developed for World Economic Forum
- Collaboration of Yale(YCELP) and Columbia U (CIESIN)
- ESI=f(Env Systems, Env Stresses&Risks, Human Vulnerability to Env Impacts, Social and Institutional Capacity, Global Stewardship)
- **Net result of the ESI: U.S. ranks below Russia & above Bolivia in 78th place**

Integrated WRM

- *Vertical Integration*: coordination and implementation of **policies** and **programs** from national level to regional and local levels
- *Horizontal Integration*: coordination and imple- mentation of policies and programs within **project** planning, across multiple agencies in a region
- *Multidisciplinary Integration*: forming teams of specialists from various disciplines
- *Multiobjective integration*: achieving social, environmental, economic and equity goals


National Water Resources Council (of Ministers)
Agriculture
Energy
Environment
Trade
Economics
Finance
"Apex" National Water Resources Planning and Policy Organization
•Water Policy
•Water Code
•National Water Management Planning
•Project Review
•Database Integration
MULTISECTORAL APPROACH
POLICY FORMULATION
•Incentives
•Subsidies
•Regulations
PLANNING/ DESIGN
IMPLEMENTATION CONSTRUCTION
MANAGEMENT OPERATIONS MAINTENANCE
REGULATORY
•Permits
•Cadaster
•NGO's
•States
•Municipalities
INTEGRATION
River Basin Commissions
Watershed Councils
•Set priorities consistent with policies, goals
•Permits, allocation
•Regional planning
•Water demand/

PLANNING

(Multiobjective River Corridor Management

Protection
(Regulatory Program)

- SAMPS
- ADIDS
- General Permits
- Nationwide Permits
- No Net Loss of Wetlands
- Wetlands Mitigation
- Banking

Development
(GI Program)

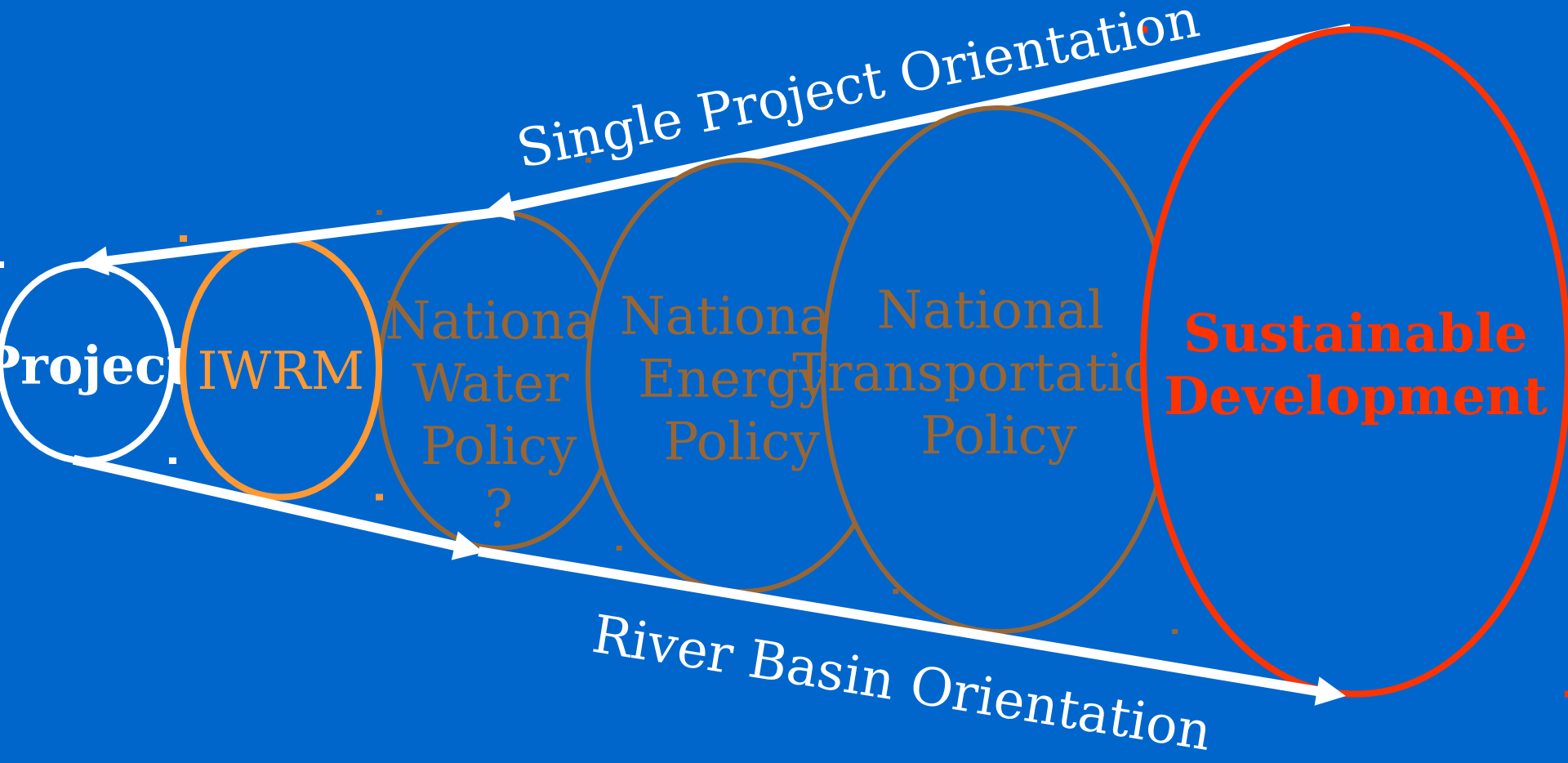
- Flood Damage Reduction
- Water Supply
- Navigation Channels, Dredging
- Reservoir Reallocation
- Ecosystem Management

Management
(O&M Program)

- Environmental Restoration
- Dredging Material Disposal
- Drought Contingency Planning
- Dam Safety
- Lock and Dam Rehabilitation
- Reservoir Systems Optimization

Project Planning/Analysis

Perspectives



Conclusions

- IWRM & SD require national water policy
- SD cannot be implemented without IWRM
- IWRM requires a nested hierarchy of river basin and watershed perspectives
- Water Resources Council is needed for national water policy formulation, intersectoral integration and interagency implementation accountability/consistency
- States, local entities are key to institutional reforms and requirements of IWRM and SD

Corps initiatives towards SD

- Challenge 21 (nonstructural FPM)
- Watershed Planning (comprehensive)
- Environ Benefits Analysis Study
- Shared Vision Planning (IJC-LOSLR, ACF/ACT
- Other FOA studies (examples?)

Non-Structural Floodplain Management

- Gilbert White, 1942 Dissertation
- Executive Order 11988, *Floodplain Mgmt* (1977)
- P&S requirement for nonstructural plan (1980)
- Water Resources Development Act (WRDA1986)
- Unified Nat'l Prog for Floodplain Mgmt (1992)
- Upper Miss R. Flood (1993)
- "Galloway Committee" Report (1994)
- "Challenge 21" Legislation (WRDA 99)

PRINCIPLES: Unified Nat'l FPM Program

- Modify Human Susceptibility to Flood Damage *(relocation, flood warning/forecasting, disaster preparedness/assistance, land acquisition, etc.)*
- Modify Impact of Flooding on People and Comm-unities *(emergency response, flood recovery)*
- Preserve and Restore Natural Floodplain Resource *(land acquisition, restore wetlands/habitats)*
- Modify Flooding *(dams, dikes, detention basins)*

CHALLENGE 21

- WRDA 99 (PL 106-53), Section 212: *"Flood Mitigation and Riverine Restoration Program"*
- *"…projects to reduce flood hazards and restore the natural functions and values of U.S. rivers"*
- *"…studies and projects shall emphasize, to the maximum extent practicable, nonstructural approaches to preventing or reducing flood damages"*
- *ensure the restoration of natural functions and values of floodplains.*

Challenge 21 CONDITIONS

- Non-federal cost-sharing partner (50% for study costs; 35% for construction costs)
- Project must significantly reduce flood damages
- Project must be justified considering all costs and beneficial outputs
- Maximum cost of individual project is $30M
- Total maximum program budget is $50M/yr
- Develop ranking criteria for candidate projects

Purpose of EBA Policy Study

- Identify and examine issues related to improving environmental benefit analysis in Corps planning
- Examine EBA requirements and possibilities for both ecorestoration and multipurpose projects
- Review state of ecological theory, concepts and models for potential adaptation
- Review issues related to current planning and evaluation requirements and flexibility
- “White paper” summarizing key issues as basis for further dialog and workshops

Why Does EBA Need Improvement?

- NRC Report recommended improvements
- Ensure that formulation/design of ecorestoration projects results in maximizing desired outputs, consistent with ecosystem management objectives
- Ensure that “best” available projects are selected to maximize ecomanagement objectives
- Improve understanding of linking ecomgmt goals, ecological properties with outputs/services
- Foster collaboration among agencies towards a common evaluation framework

Precursors to EBA

- Policy Study: “New Directions for Corps Environmental Activities” (1993)
- Policy Study: “Incremental Cost Analysis” (1995)
- Policy Study: “Civil Works Environmental Action Plan” (1995)
- Policy Study: “Sustainable Development Concepts” (1998)
- NRC Report on Corps Planning (1999)
- Policy Study: “Implementation Steps for SD (’02)

NRC(1999) Report Recommendations

- Thoroughly review the P&G, modify and incorp-orate contemporary techniques and public values
- Improve analytical techniques for environmental benefits and detriments assessment
- Develop standardized set of tools for quantifying benefits and costs

The EBA Evaluation Dilemma

- Corps regulations state that the purpose of restora-tion is to return ecosystem to a close approxima-tion of the natural state (EP 1165-2-502, 1999)
- E**cologist's** goal is to restore ecological properties.
- **Economist's goal** is to enhance ecosystem ***services*** that contribute to human welfare
- Links between ecosystem *functions/outputs* and *services* are difficult to define, much less quantify, and can not be readily valued in monetary terms
- What is NER? – the missing link

Type of Values	Ecosystem Services	Valuation Methods
Direct use value in production	Direct Production Services • Land for food & fiber production • Hydroelectric power generation • Water input for ag & industry •Marketed fish, wildlife, raw materials	•Market •Production function
Direct use value in consumption	Direct Consumption Services • M&I water supply •Reservoir-based recreation •In-stream recreation •Aesthetics	•Production function •Revealed preferences •Stated preferences
Indirect use value	Indirect Services • Flood storage & attenuation •Water treatment & decontamination •Sediment trapping •Biological control of nuisance & disease •Climate regulation •Biological diversity/genetic store	•Production function •Avoided damages •Replacement cost
Non-use value	Rare or unique	•Stated

Ecosystem Properties		Ecosystem Services	
Structure	**Function**	**Natural (EQ/NER)**	**NED-type services**
•Biomass •Sediment •Water •Vegetation •Species Diversity	•Nutrient cycling •Primary productivity •Hydrologic variability •Life support	•Genetic material •Climate regulation •Rare species	•Recreation •Water Supply •Flood retention •Food •Fiber •Waste Treatment •Hydropower

Structure: the spatial arrangement of material in an ecosystem at any one time and sequentially through time (sediment, biomass)

Function (process): The biological, physical and

EBA Challenge

- Corps regulations say that ecorestoration (NER) outputs are to be quantified in non-$ units, and that alternative NER plans are to be evaluated using CE/ICA
- Primary challenge is to identify existing or develop new ecological assessment methods that can account for the range of ecosystem functions and natural services beyond HU's

The Search for Inclusive EBA Measures

- NRC (1999) criticized the HU (habitat unit) be-cause it fails to capture all the significant unprice-able values of ecosystem function.
- **Ecological Integrity** - the relative completeness of ecosystem structure and function
- **Species Diversity** - species number (richness), and abundance
- ***Most common measure of ecosystem integrity is species richness (#'s not abundance)***

Types of Models Reviewed

Species Based Habitat Indices

- HEP/HSI (Habitat Evaluation Procedures
- IFIM (Instream Flow Incremental method)

Community-based Habitat Indices

- WVA (Wetland Valuation Assessment)
- IBI (Index of Biotic Integrity)
- WCHE (Wildlife Habitat Evaluation)
- RCHARC (Riverine Community Habitat Assessment and Restoration Concept)
- HGM (Hydrogeomorphic Method)

Types of Models Reviewed

Ecosystem Simulation Models –

Modeling of ecosystem functions, processes and management actions

- CASM (Comprehensive Aquatic System Model)
- SDS (Successional Dynamics Simulation)
- FRAGSTATS
- PATCH

Spatially linked simulation models

Review of Existing Models

- Few species-based models approach necessary habitat inclusiveness
- Community models are more habitat-inclusive, including endangered species
- Index of Biotic Integrity (IBI) is the best available concept - it is multidimensional and widely used
- Improvements in IBI & other similar models , such as Wildlife Community Habitat Evaluation (WCHE) model require site specific calibration

Ecosystem Simulation/Process Models

- Have ultimate utility because they are process explicit, flexible and based on direct representation of ecol.structure and function
- Provide best means for integration with econ valuation, i.e. production/response functions are specified/quantified
- Require greatest investment in development theory not well-developed yet.

Alternative Strategies for Improving EBA

- Track 1 - **Incremental Strategy** (focus on new ecol. index models, upgrade CE/ICA to include multiple ecosystem mgmt goals, use existing regs for evaluating joint outputs)
- Track 2 - **Next Generation** (develop new process models, opportunity cost tradeoffs)
- Track 3 - **General NED Framework** (work on quantifying ecol services as basis for full NED monetization (“the full Monty”)

Near Term Protocols

	Small Studies/Projects	Large Studies/Projects
Single Purpose	*e.g.*, CAP 1135, 206,204	*e.g.*, 1103, Ohio River, CWPPRA
	•Ecological analytical methods (e.g., HEP, IBI) •Economic framework •Cost allocation •Cost sharing	•Ecological analytical methods (e.g., IBI ,HEP, HGM) •Economic framework •Cost allocation •Cost sharing
Multipurpose	*e.g.*, Challenge 21 (Sec 212)	Everglades, Louisiana 2050, Lake Ontario/St Lawrence
	•Ecological analytical methods (e.g., HGH, HEP) •Economic framework •Cost allocation •Cost sharing	•Ecological analytical methods (e.g., IBI ,HEP, HGM) •Economic framework •Cost allocation •Cost sharing

Draft Strategy for Improving EBA

Component	Near Term (can address immediately)	Mid-range - effort & resources (next 2-3 years)	Long-Range (5-8 years)
Models and Methods	- Define toolkit and develop kit strawman	- Examine broader suite of community models - "fill" toolkit -	R&D program -
Policy and Guidance	- Clarify policy (NER) - Assure consistency w/sustainability efforts - Other	- Update Eco-Rest Policy EC and planning manual(s) - -	-Update guidance if needed - -
Capability - planning and evaluation	- Incorporate into Planning Modules being developed -NER focused evaluation workshops	- Refine the Planning Modules being developed - Seek cooperative training opportunities with FWS/NMFS/EPA/NRCS	- TBD - Develop new training (possibly interagency)
Capability - model application	- HEP & HSI selection and application lessons learned and user group -	- HEP & HSI selection, application & development workshops; toolkit - cooperative training opportunities	- TBD - - -

Incremental

Next Generation

Potential Strategies – EBA Track 1 – Incremental Strategy

Model A (e.g., HEP)

Ecosystem Restoration Programs (1103, 1135, 204, 206)

But which is the best ecological model?

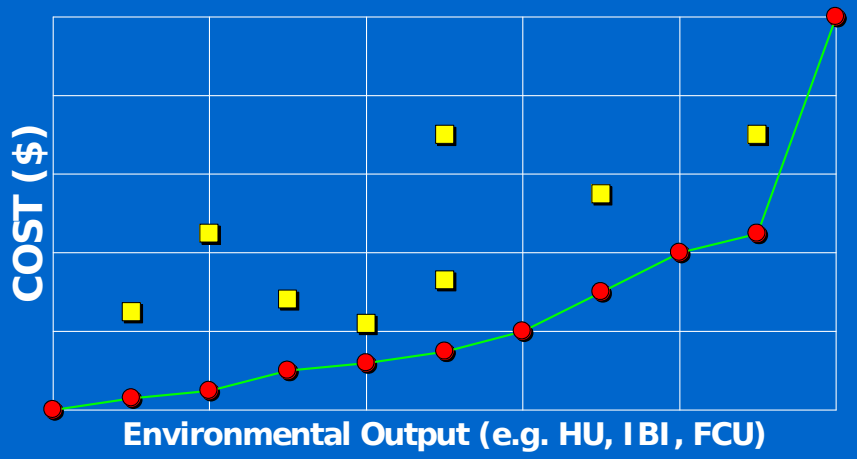
Model B (e.g., IBI)

Model C (e.g., RCHARC)

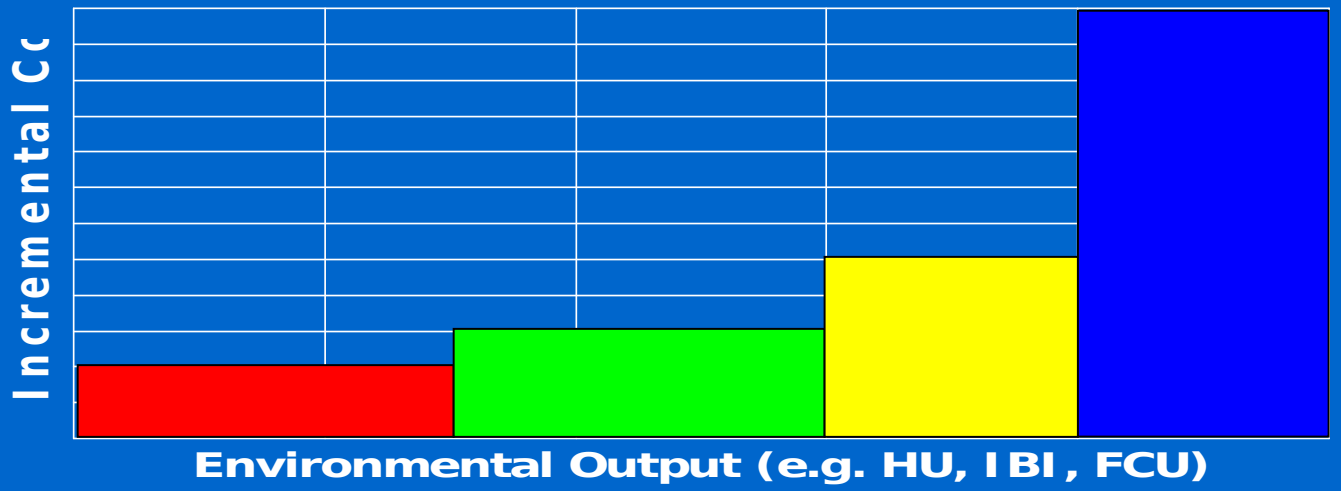
Model X

Different models appropriate for different ecosystem management goals

COST EFFECTINESS ANALYSIS



INCREMENTAL COST ANALYSIS

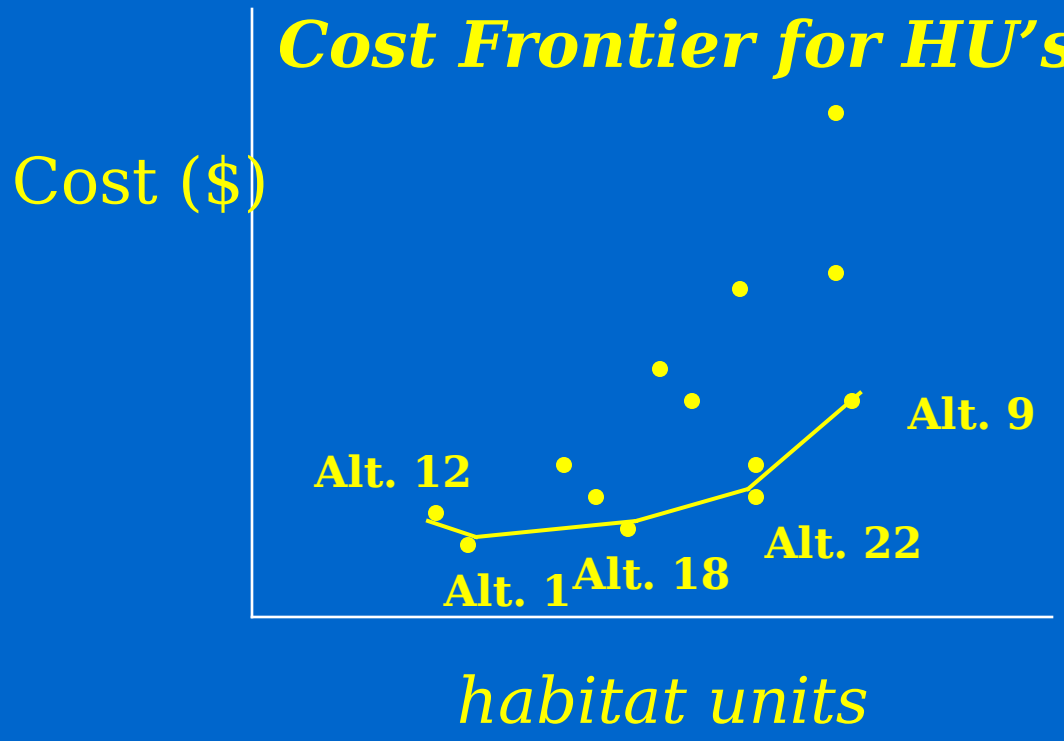


Potential Strategies – EBA Track 1 – Incremental Strategy

Different models appropriate for different ecosystem management goals

Model A (e.g., HEP)

Maximize habitat suitability for species *j*



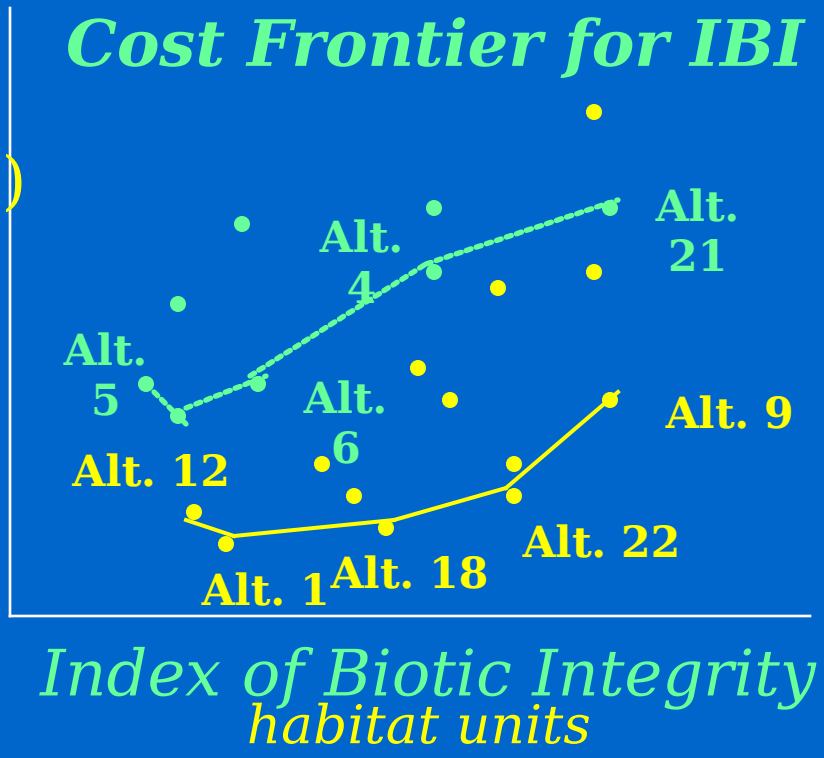
Potential Strategies – EBA

Track 1 – Incremental Strategy

Different models appropriate for different ecosystem management goals

Model B (e.g., IBI)

Maximize biodiversity



Potential Strategies – EBA

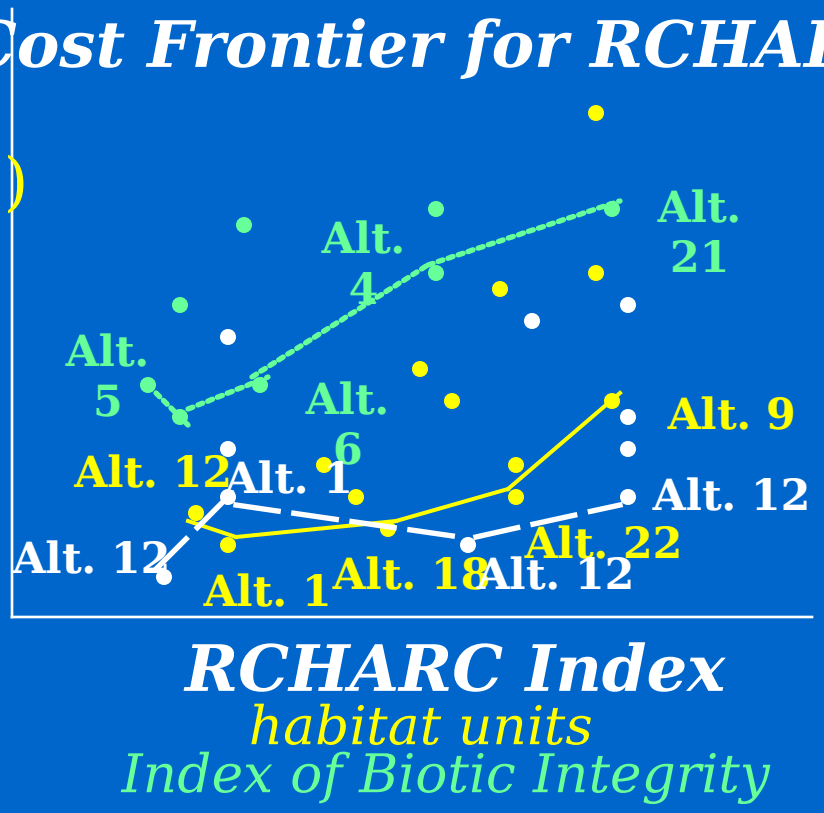
Track 1 – Incremental Strategy

Different models appropriate for different ecosystem management goals

Model C (e.g. RCHARC)

Maximize hydrologic variability

Next generation IWR-PLAN should solve for best plan with criteria weights



Potential Strategies – EBA
Track 2 – Next Generation

NED/NER
PGN

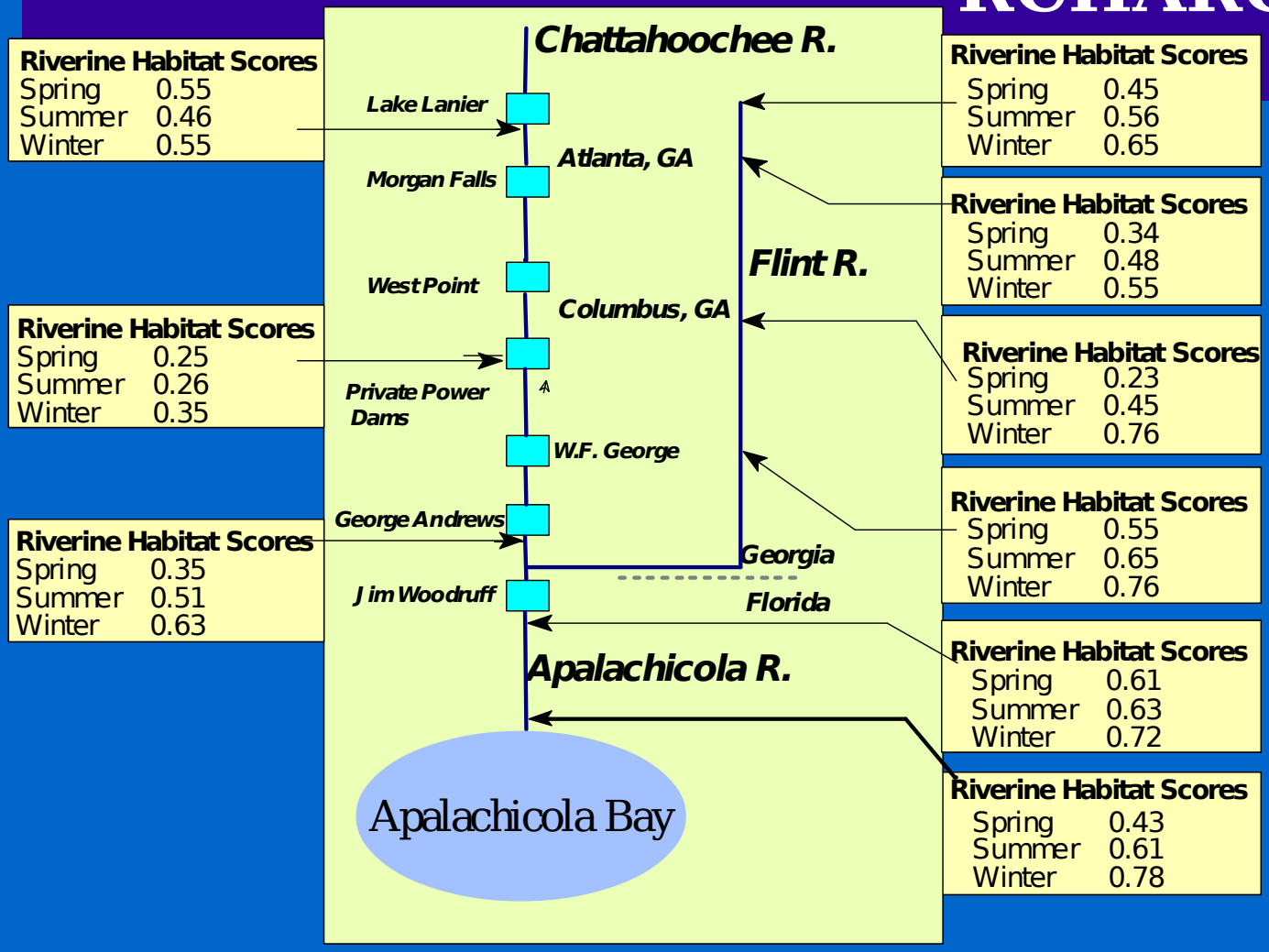
Mixed Purpose Projects

Incl. Ecosystem Restoration

e.g., Challenge 21

Ecological Simulation Models

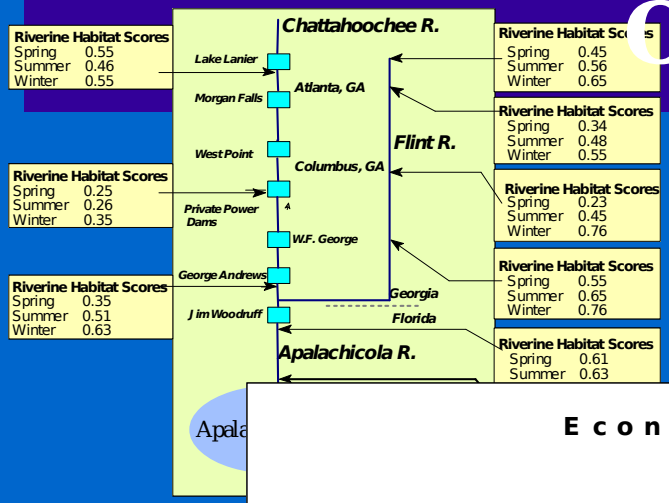
ACT-ACF Study used RCHARC indices.

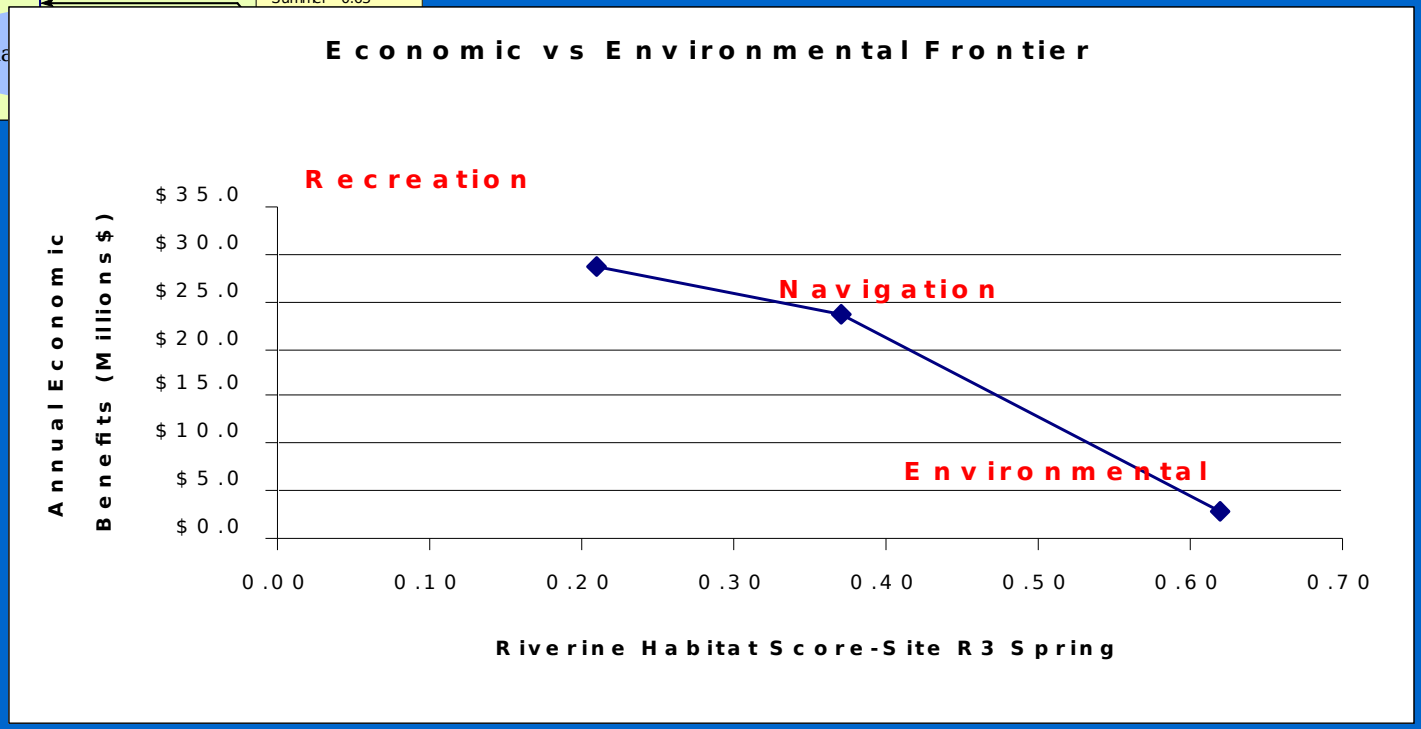


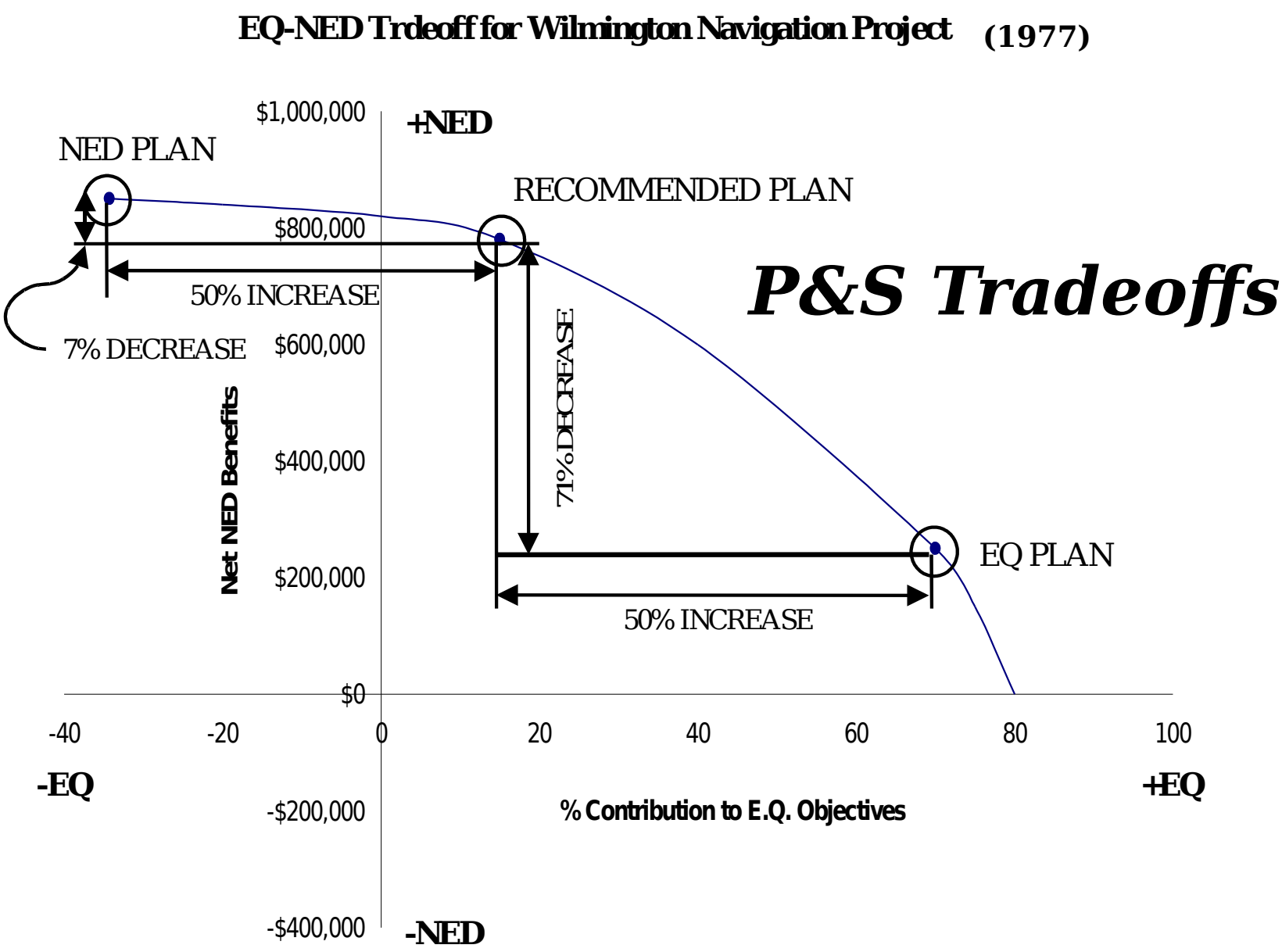
Riparian Index Shown in this schematic

Opportunity cost tradeof

3 alternatives,
3 RCHARC output levels

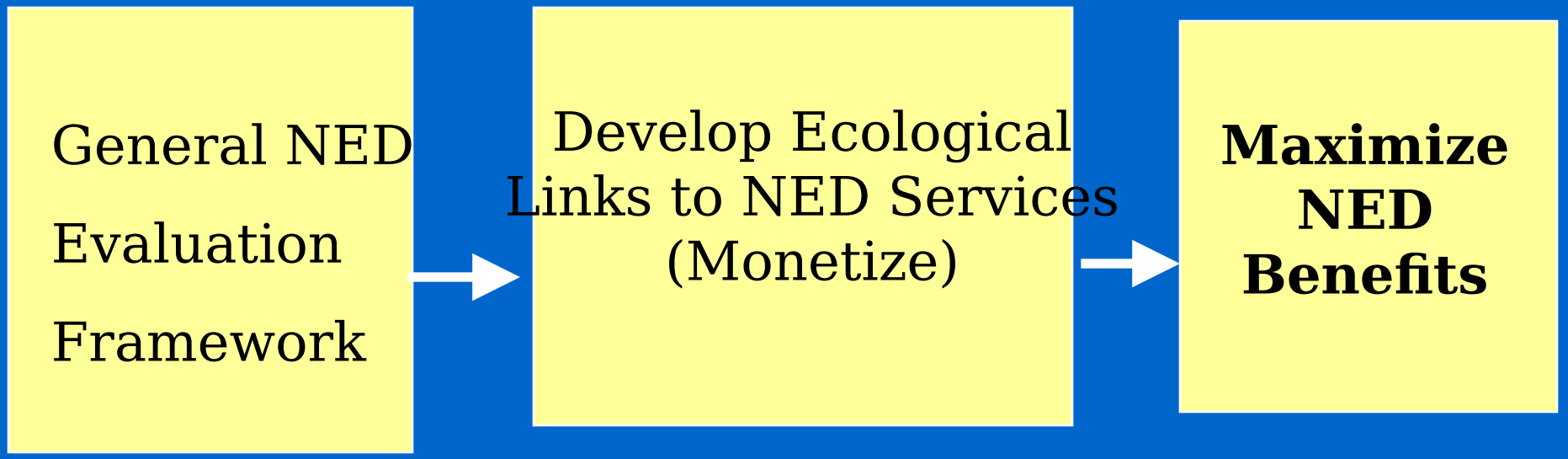





EQ-NED Trdeoff for Wilmington Navigation Project (1977)
$1,000,000
+NED
NED PLAN
RECOMMENDED PLAN
$800,000
50% INCREASE
7% DECREASE
$600,000
Net NED Benefits
71% DECREASE
$400,000
$200,000
EQ PLAN
50% INCREASE
$0
-40
-20
0
20
40
60
80
100
-EQ
+EQ
% Contribution to E.Q. Objectives
-$200,000
-$400,000
-NED
P&S Tradeoffs

Potential Strategies – EBA

Track 3 – “Full Monty”



Improvements for EBA (Environmental Benefits Analysis)

"White Paper" Mar 2001

TRACK 1 – Improve Current Procedure

- Analytical Protocol for NED/NER analysis
- Link evaluation to broader range of ecological models

TRACK 2 – Next Generation

- Develop NER/EQ account to reflect "goods and services" approach
- Expand ecological models to include process (simulation) models
- Initiate interagency dialogue

"Next Generation"

- EBA Report
- Develop NER/EQ Accounting Framework for "environmental goods and services"
- Improve Ecological evaluation methods, especially process simulation models (for larger projects)
- Corps Economic & Environmental Wkshop
- Interagency Workshops

Shared Vision Planning

Explanation of the Method
Examples of Application

IJC Lake Ontario-St. Lawrence R. Study

Multiobjective Planning/
Harvard Water Program
1962/P&S/P&G/ -
Updated IWR 1994

Adaptive Environmental
Management
C.S."Buz" Hollings
1978

Shared Vision Model
Richard N. Palmer 1981,
1992

The Shared Vision Model

Stakeholder
Value Judgements

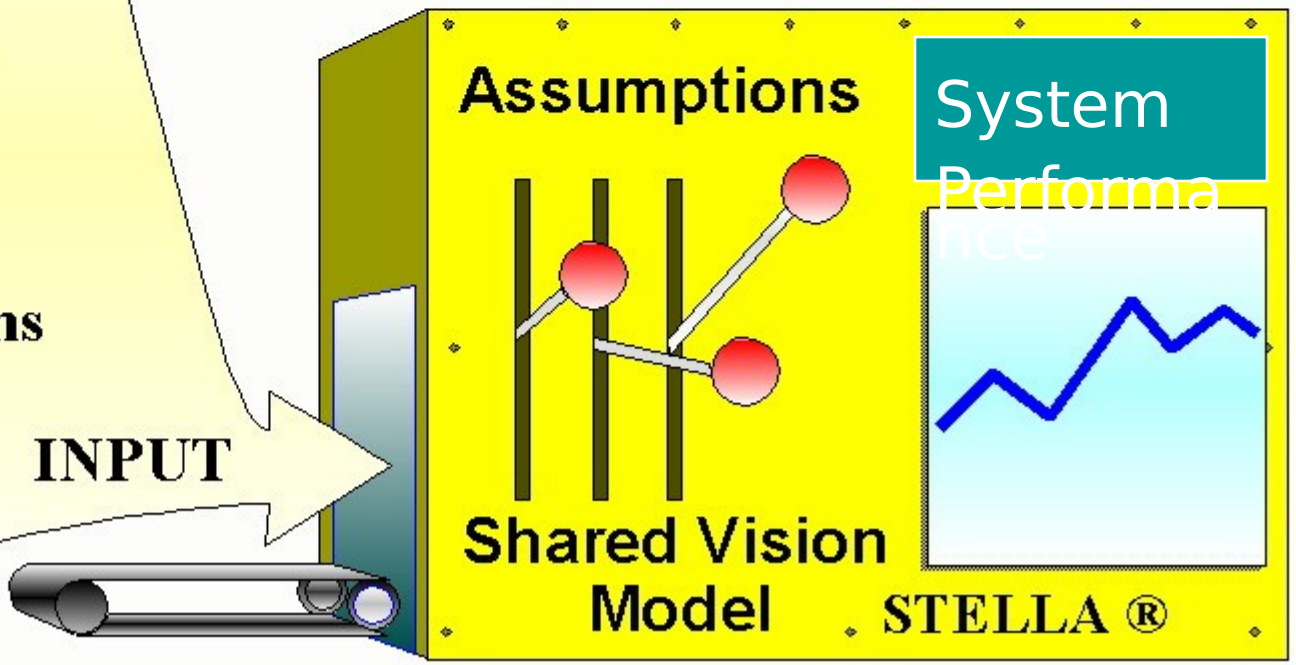
Demand Forecasts

Hydrology

Economic Functions

Environmental
Functions

INPUT



Goal Objective⇒ Criteria	Sustainable Development				Reduce Vulnerability	
	Econ.	Envir.	Equity	SWB	Safety	Reliability
Mgmt. Measure	$ Costs & Benefit	W.Q. Habitat Diversity	Income Distribution	Relocate	Population at Risk	Frequency of Failure
MM_1						
…						
MM_i						
…						
MM_n						

Management ⇒ (Adaptive) Measures

- Structural / infrastructure
- Legal / legislative
- Institutional / administrative
- Regulations (land use, zoning, standards)
- Education
- Financial incentives, subsi
- Taxes, tariffs, user fees (-)
- Research and development
- Market mechanisms
- Technology development

Shared Vision Planning

- Based on classic water resources planning principles and procedures
- Adds adaptive management (iterative learning and revision of plans)
- Builds on active public participation
- Employs latest computer technology to engage all levels of decisionmaking

Shared Vision Planning Model

- Simulates operation of water system
- Allows easy formulation of new structures or rules of operating the system
- Shows how changes in hydraulics and hydrology affect what stakeholders and decision makers care about – treaty concerns, economics, legal requirements, environment, flooding, public interests, etc.

Shared Vision Planning

- Combines public involvement process with planning formulation process and technical data to facilitate choices(eval)
- Incorporates different tools/models for various evaluation purposes
- Basic structure/housing for all data and models is an Excel spreadsheet format

Planning Steps

1. Build a team and identify problems.
2. Develop objectives and metrics for evaluation.
3. Describe the future without the help of this study
4. Formulate alternatives to the status quo.
5. Evaluate alternatives and develop study team recommendations.
6. Institutionalize the plan.
7. Exercise and update the plan

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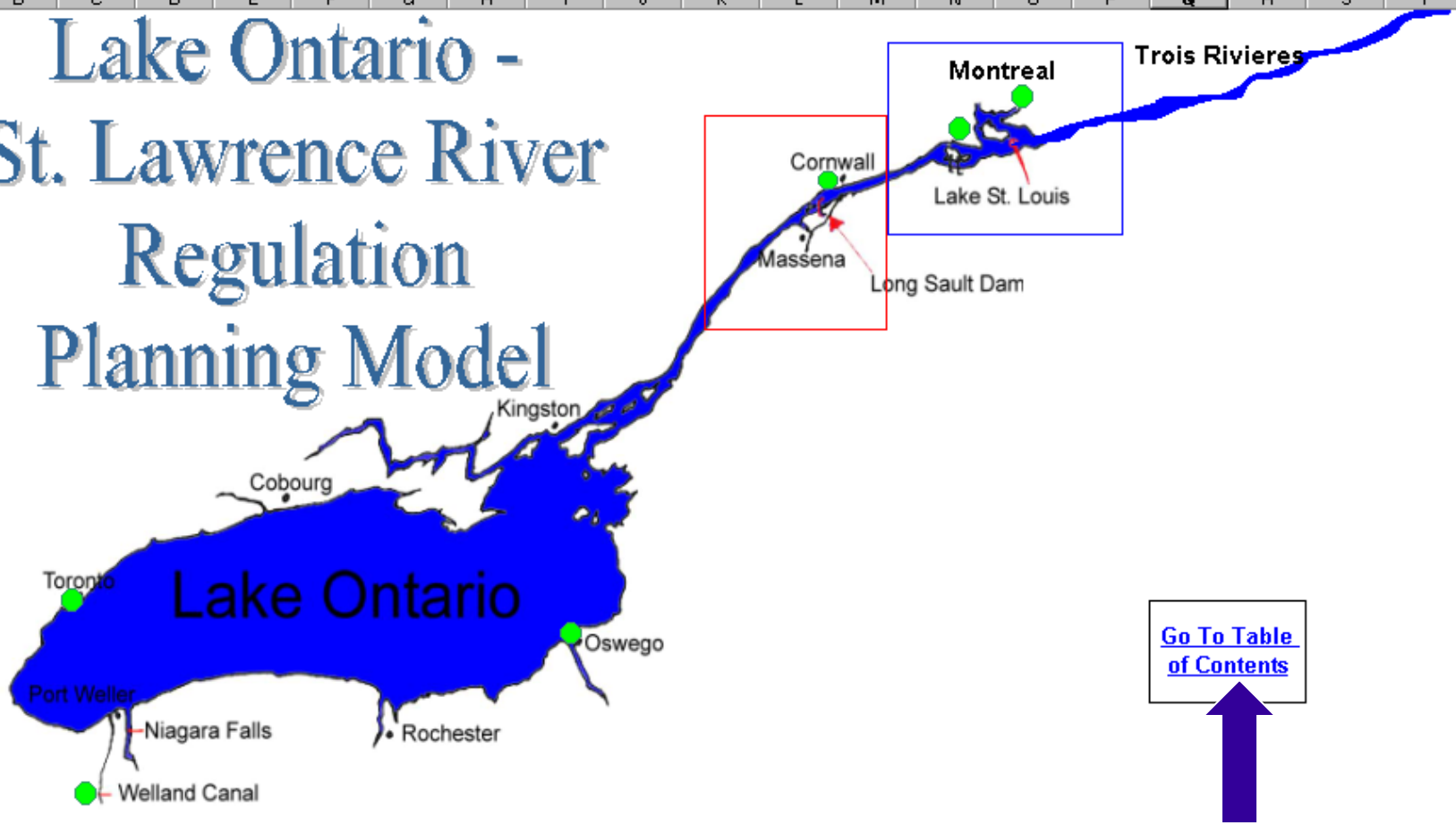
Lake Ontario - St. Lawrence River Regulation Planning Model



Go To Table of Contents

Cover | Contents | Decisionmakers | DecisionFactors | Goals&Objectives | Design Alt | Validity

Draw AutoShapes

Table of Contents

Title Page and Maps

Decision Makers, Stakeholders, and Vetoers

Goals and Objectives

Decision Factors and Performance Metrics

Design an Alternative Regulating Policy

Simulation Calculations

Comparison of Alternatives

Commercial Navigation

Hydropower

Domestic, Industrial and Municipal Water Uses

Recreational boating/Tourism

Coastal Processes

Ontario Lake Levels and St. Lawrence Flows (graphs and statistics)

Validity tests of the simulation in this model

References and Reports

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St. Lambert Lock

Closeup Map

Main Map

St. Lambert Lock

Almost directly across Montreal harbour lies the protecting dyke of the channel giving access to the Seaway. This channel begins just east of the Jacques Cartier Bridge (during Seaway construction, this bridge was literally "jacked up" some 15.2 m (50 feet) to provide the required clearance), passes beneath the bridge and extends for 4.8 km (3 miles) before reaching the first lock of the Seaway, the St. Lambert Lock, located at the southern end of the Victoria Bridge. An ingenious diversion system that includes a lift span at each end of the lock allows the heavy rail and road traffic to proceed uninterrupted to and from the bridge.

The St. Lambert Lock lifts the ship some 4.5 m (15 feet) from the level of the Montreal harbour to that of the Laprairie Basin through which the channel sweeps in a great arc, 13.7 km (8.5 miles) long, between its protecting embankments to the second lock.

http://www.seaway.ca/english/features/mlofeatur/history.html

Cover Contents Decisionmakers DecisionFactors Goals&Objectives Design Alt Validity

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Lake Ontario-St. Lawrence River Regulation Study
Planning Model

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References and Reports

Double-click to read about the purpose of this model

Cover | Contents | Decisionmakers | DecisionFactors | Goals&Objectives | Design Alt | Validity

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Goals, Objectives and Performance Metrics

Return to Table of Contents

by Bill Werick, nobody else!

Goals

The International Joint Commission prevents and resolves disputes between the United States of America and Canada under the 1909 boundary Waters Treaty and pursues the common good of both countries as an independent and objective advisor to the two governments.

Accordingly, the goals for this study are to:

1. Improve the economic and environmental prosperity of both countries;
2. Avoid undue negative impact to any party, especially those interests identified in the Boundary Waters Treaty and the Orders of Approval for the St. Lawrence Seaway Project
3. Enhance the peaceful and productive relationship between the two countries in all matter related to the management of releases from Lake Ontario.

Objectives

1 Increase the reliability of navigable conditions in Lake Ontario and the St. Lawrence River.
2 Increase the dependable capacity of hydropower plants along the St. Lawrence River.
3 Increase the reliability and quality of recreational boating in Lake Ontario and the St. Lawrence River.
4 Reduce coastal damages from flooding and erosion along the shores of Lake Ontario and the banks of the St.
5 Enhance the quality and increase the quantity of riparian wetlands in Lake Ontario and along the St. Lawrence River.
6 Maintain the reliability of municipal water supplies from Lake Ontario.

Cover Contents Decisionmakers DecisionFactors Goals&Objectives Design Alt Validity
Draw AutoShapes

Planning objective

Increase the reliability of navigable conditions in Lake Ontario and the St. Lawrence River.

Performance Indicators	This Plan	Versus Base (+, - , 0)
None so far.		

Hydraulic Attributes

Orders of Approval

a. Montreal Harbour not lower than pre-project		
Minimum mean monthly outflow from Lac Ste. Louis, Apr1-Dec2		
Frequency of Lac Ste. Louis outflows below 6,513 m^3/sec		
Frequency of Montreal Harbor levels below 19.0 m.		
f. Consistent with other requirements, lowest maximum release from Lake Onta		
Flows vs Lake within prescribed "envelope"		
j. Lake Ontario shall not be below 74.0 m. during the navigation season	60%	--

Preferance Indicators

Minimize frequency of Lake Ontario levels < 74.3
Minimize frequency of Lake St. Lawrence levels < 72.7 at Long Sault
Minimize frequency of Lake St. Lawrence levels < 73.5 at Long Sault
Minimize frequency of flows > Plan 1958D "L" Limit
Maximum flows < 991 10m3/sec
Minimize frequency Lac Ste.Louise levels < 20.7
Minimize frequency Montreal Harbour levels < 6.2 m. year-round
Minimize frequency Montreal Harbour levels < 6.2 m. (Sep4-Dec3)

Interest Satisfaction

Lake Ontario	50.2	--
St. Lawrence River	37.8	-
Lac Ste. Louis	82.7	0

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Select or Design a Regulating Plan

Return to Table of Contents

Return to Table of Contents

Look at Simulation Worksheet

Comparison of this plan to the baseline

Selected: Plan A

Pick a basic alternative to evaluate

1958-D
Plan A
Plan B
Plan C
Plan D
Customized Plans

This plan has no supply indicator adjustments for how wet or dry it has been (although higher lake levels naturally cause higher releases) and there are no limits of any sort on the release because of season (P and M Limits) or ice (I Limit) or sudden changes (J Limit). The February-July "curve of zero supply indicator is used.

L
Existing
Modified
as26

1
1.1
1.2
1.3
as42

M
100%
95%
90%
85%
at26

A pre-defined plan has been selected.

L	Existing
M	Existing
J	Existing
P	Existing
P*	Existing

J
Always 566 m3/sec
1132 m3/sec if Ontario > 76.2
Enter your own
aq26

Custom Rule Curv
061

Adjust rule curves

P
1
1.1
1.2
aw27

P*
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0.9
0.8
aw28

Contents Decisionmakers DecisionFactors Goals&Objectives Design Alt Validity Simu

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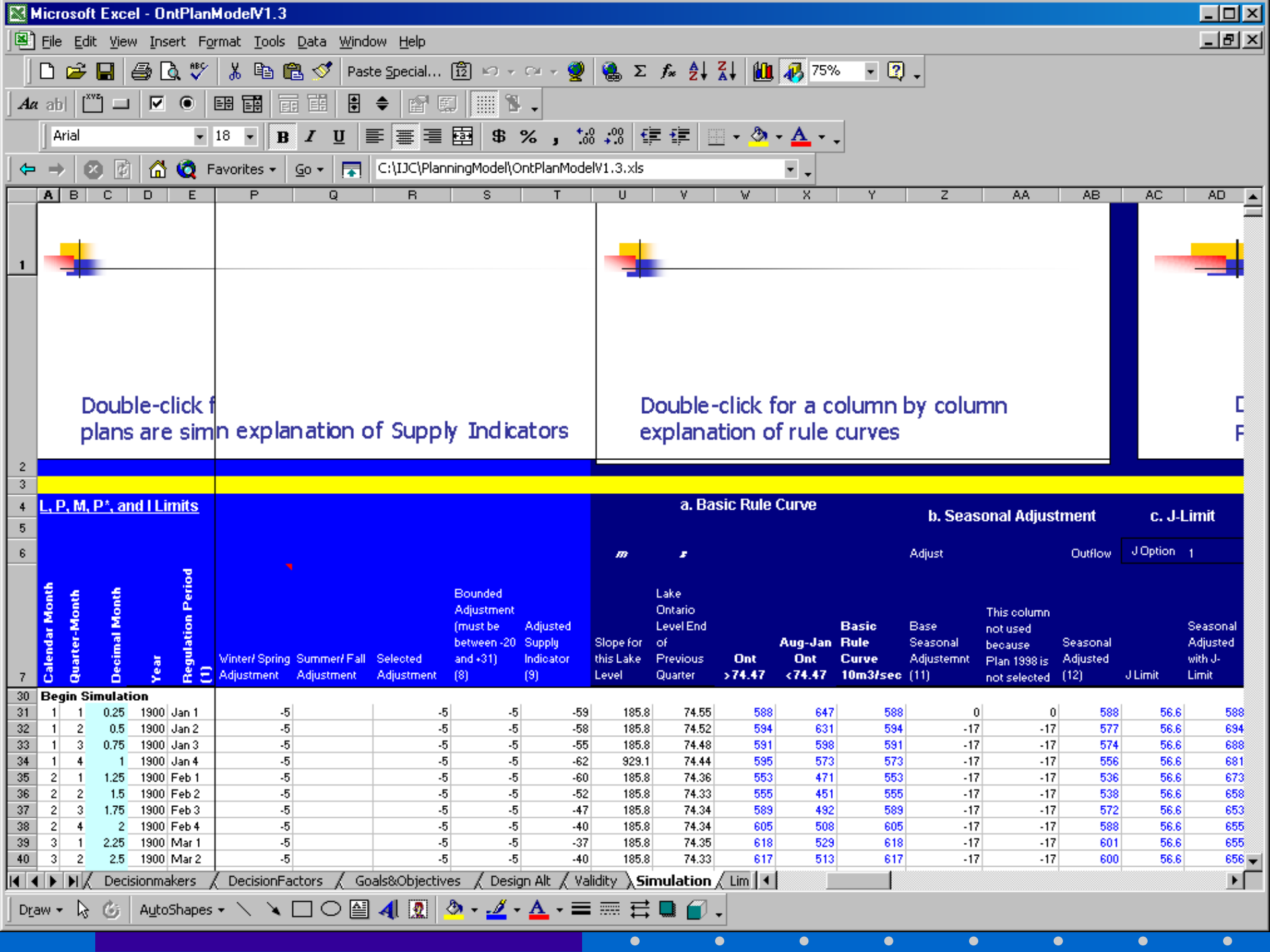
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Double-click f
plans are simn explanation of Supply Indicators
Double-click for a column by column
explanation of rule curves
L, P, M, P*, and I Limits
a. Basic Rule Curve
b. Seasonal Adjustment
c. J-Limit
Adjust
Outflow
J Option 1
Calendar Month
Quarter-Month
Decimal Month
Year
Regulation Period (1)
Winter/ Spring Adjustment
Summer/ Fall Adjustment
Selected Adjustment
Bounded Adjustment (must be between -20 and +31) (8)
Adjusted Supply Indicator (9)
Slope for this Lake Level
Lake Ontario Level End of Previous Quarter
Ont >74.47
Aug-Jan Ont <74.47
Basic Rule Curve 10m3/sec
Base Seasonal Adjustemnt (11)
This column not used because Plan 1998 is not selected
Seasonal Adjusted (12)
J Limit
Seasonal Adjusted with J-Limit
Begin Simulation
Jan 1
Jan 2
Jan 3
Jan 4
Feb 1
Feb 2
Feb 3
Feb 4
Mar 1
Mar 2
Decisionmakers
DecisionFactors
Goals&Objectives
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Net Basin Supply Before and After Regulation

L

Existir
S

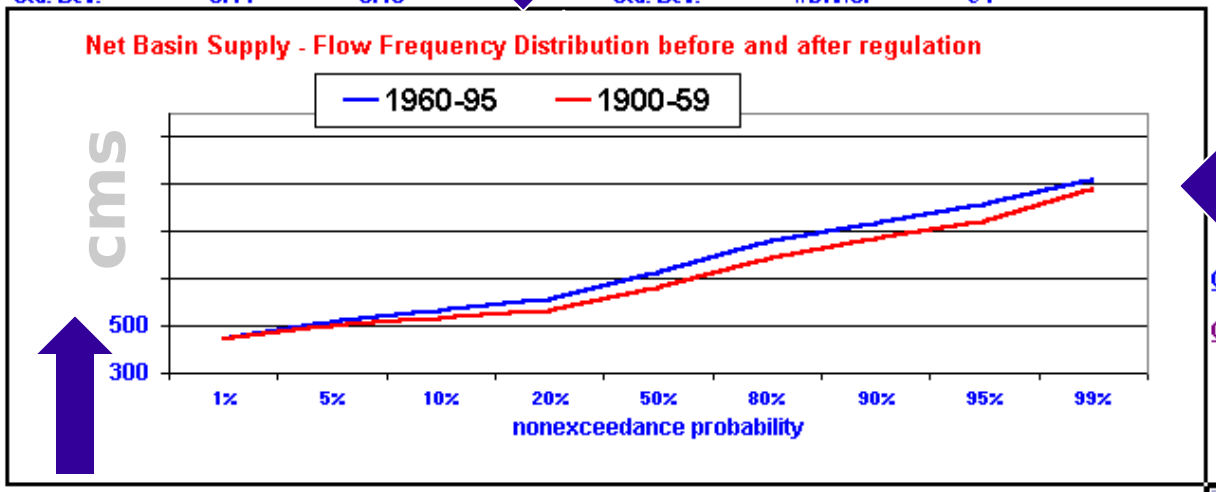
Paramete

Split Net Basin Supply Statistics
're and Post Approval of 1958-D)

ameter	1900-59	1960-95
n	682	737
	1,353	1,302
	335	400
Dev.	136	147

Mean					
Max	77.12	77.10	Max	595	878
Min	73.68	73.68	Min	595	532
Std. Dev.	0.44	0.43	Std. Dev.	#DIV/0!	94

Frequency Distributions



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Post 1960 As Dry But Wetter Than 1900-59

Wetlands | Coastal | RecBoating | Municipal | Sheet1 | H&H Graphs | Compare | Library | Hy

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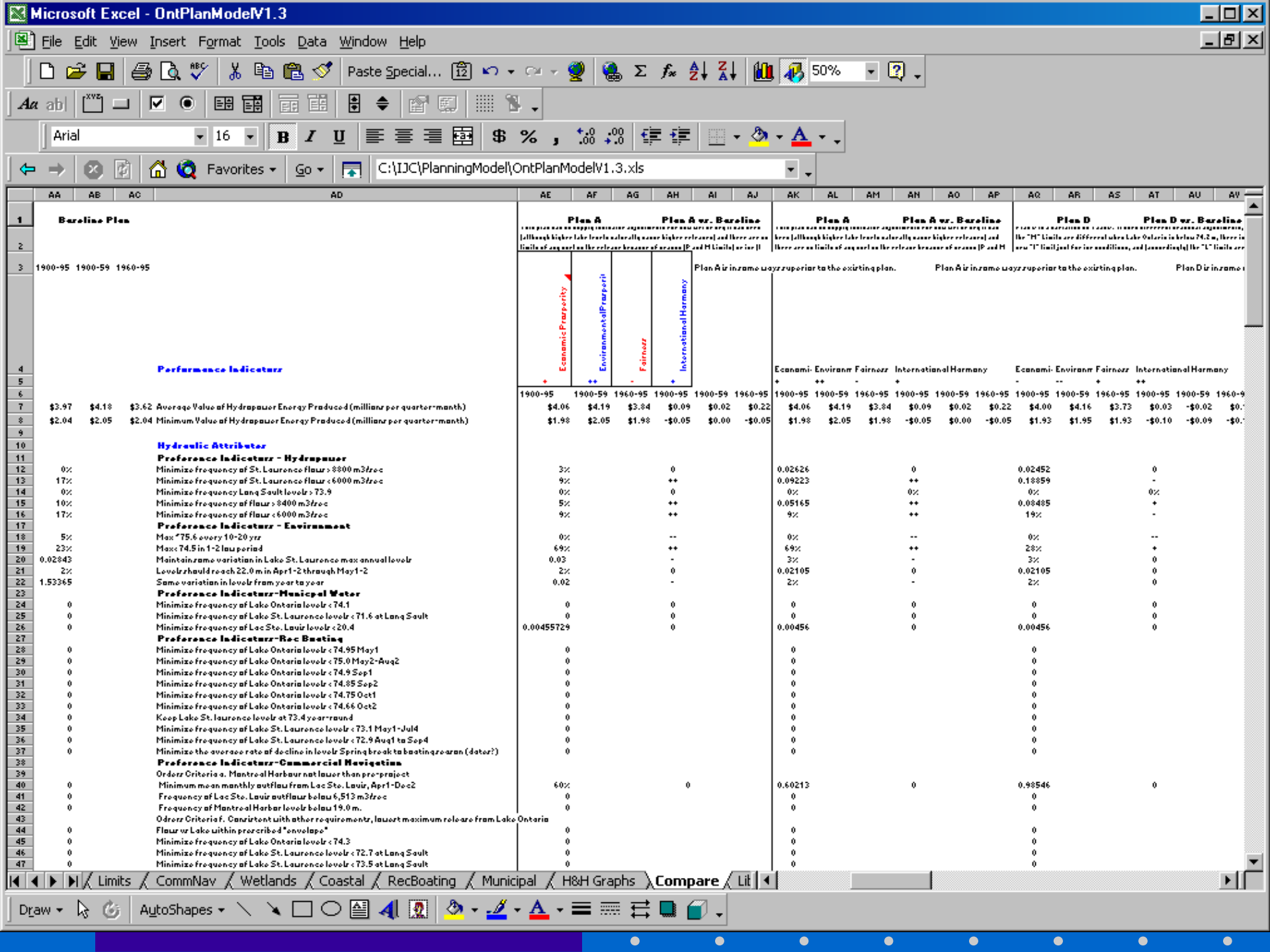
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Baseline Plan
Performance Indicators
Hydraulic Attributes
Preference Indicators - Hydropower
Preference Indicators - Environment
Preference Indicators-Municipal Water
Preference Indicators-Rec Boating
Preference Indicators-Commercial Navigation
Plan A
Plan A vr. Baseline
Plan D
Plan D vr. Baseline
Economic Prosperity
Environmental Prosperity
Fairness
International Harmony
Limits
CommNav
Wetlands
Coastal
RecBoating
Municipal
H&H Graphs
Compare
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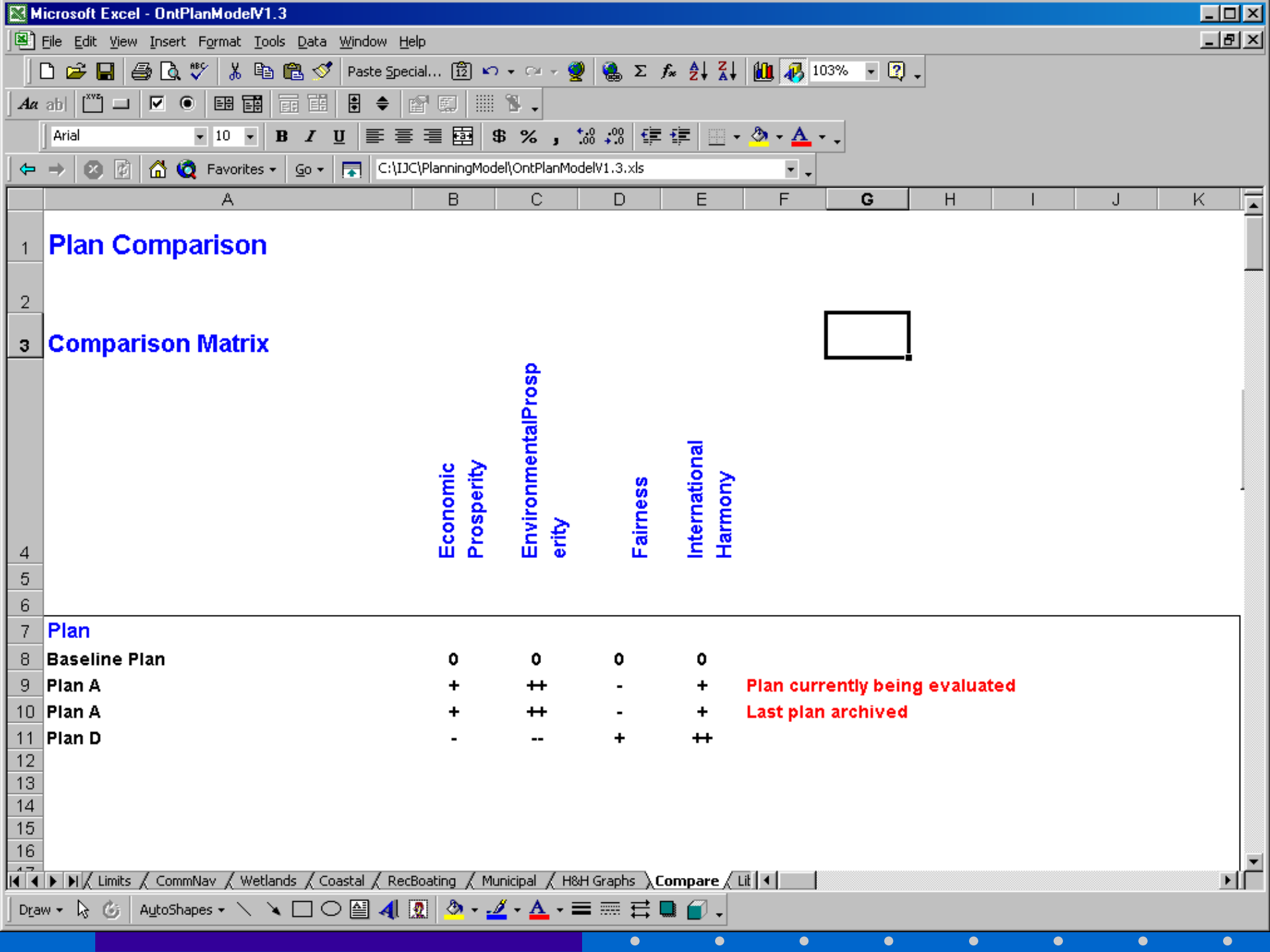
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Plan Comparison
Comparison Matrix
Economic Prosperity
EnvironmentalProsperity
Fairness
International Harmony
Plan
Baseline Plan 0 0 0 0
Plan A + ++ - + Plan currently being evaluated
Plan A + ++ - + Last plan archived
Plan D - -- + ++
Limits CommNav Wetlands Coastal RecBoating Municipal H&H Graphs Compare Lit
Draw AutoShapes

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Study Mission

Plan 1998

Boundary Waters Treaty

Mock Report

Evaluation of Current Plan

Click on the cover of the reference to open it. Use the buttons on the bottom of the screen to move between model and reference.

Table of Contents for Model

CommNav Wetlands Coastal RecBoating Municipal H&H Graphs Compare Library

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Document in OntPlanModelV1.3 - Microsoft Word
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Heading 1 Times New Roman 18
MOCK REPORT –DOES NOT REPRESENT STUDY BOARD POSITIONS – FOR USE AS A MODEL FORMAT ONLY. To return to model, use the file pull down menu, select close & return

Mock Report

International Study of the Regulation of Lake Ontario and the St. Lawrence River

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Page 1 Sec 1 1/9 At 1" Ln 1 Col 1 REC TRK EXT OVR

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MOCK REPORT –DOES NOT REPRESENT STUDY BOARD POSITIONS – FOR USE AS A MODEL FORMAT ONLY. To return to model, use the file pull down menu, select close & return

MOCK REPORT 1

OVERVIEW 3

Study Parameters 4

Basis for recommending a new plan 5

GOALS 6

PROBLEMS AND OPPORTUNITIES 6

Planning Objectives 7

EXISTING AND FUTURE CONDITION WITHOUT CHANGES FROM THIS STUDY 7

ALTERNATIVES 7

Baseline Plan 7

Plan A 8

Draw AutoShapes
Page 2 Sec 1 2/9 At Ln Col REC TRK EXT OVR

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Normal Times New Roman 12
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Existing and Future Condition Without Changes from this Study

Alternatives

Baseline Plan

The basic set of rules used now to regulate Lake Ontario levels and releases is called "1958D". It was designed to strike an acceptable balance between the interests of navigation, hydropower and shoreline property owners based on water conditions that had been experienced up to that time. Deviations from the written rules that would benefit navigation or hydropower are allowed when water supply is not the same as the 1880-1960 inflows, but these deviations are not programmed into the 1958D alternative (select 1958D with deviations if that's what you want to evaluate).

Draw AutoShapes
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Document in OntPlanModelV1.3 - Microsoft Word
File Edit View Insert Format Tools Table Window Help
Normal Times New Roman 12
Favorites Go C:\IJC\PlanningModel\OntPlanModelV1.3.xls!Library!Object 38

MODEL FORMAT ONLY. To return to model, use the file pull down menu, select close & return

Comparison of Alternatives

	Economic Prosperity	EnvironmentalProsperity	Fairness	International Harmony
Baseline Plan	0	0	0	0
Plan A	+	++	-	+
Plan D	-	--	+	++

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Future

- More and more use of shared vision planning until it is the norm
- More and more computer integration – internet, GIS, satellite data, etc.
- More and more supportive of disciplined public involvement.
- Cheaper, faster, better.